Integrated Control of Weeds in Small Grains in Nebraska
Cooperative Agreement between USDA/ARS and UN-L
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1. Survey winter grain areas of Nebraska for type and intensity of weed problems in small grains.

Data compilation from the 1980 and 1981 surveys of winter wheat fields across Nebraska is now complete. 1980 data has been placed on computer diskettes, 1981 data has been assembled and is ready to be placed on diskettes. After this process is completed the 2 years data will be analyzed separately and as a single set. Data from specific parts of the state will also be analyzed separately. Using the other observations taken (distance into field, previous crop, tillage methods, row spacing, and plant vigor and height) we hope to be able to relate weed population to specific producer practices.

Preliminary analysis of the data indicate that in the eastern portion of the winter wheat growing area green and yellow foxtail are the most common grass weeds, Pennsylvania smartweed and yellow woodsorrel the most common broadleaves, and field bindweed the most common perennial weed species found. In the western portion barnyardgrass and green foxtail were the most common grass weeds, broadleaf species were not as common and were more diverse.

2. Screening winter wheat cultivars with weeds.

A. Comparison of competitive ability of winter wheat cultivars under field conditions with the growth characters of winter wheat seedlings in the laboratory.

Research was conducted during 1979 and 1980 to assess competitive ability of 85 winter wheat cultivars to weeds and establish the relationship of the weed competitive ability of these genotypes in the field (North Platte, Nebraska) versus their performance in laboratory experiments. The average number of weeds and yields observed for selected cultivars is presented in Table 1 and the growth characters of these selected cultivars are presented in Table 2. Results indicated that the presence of weeds in the spring season of fall seeded winter wheat was independent of genotypic seedlings growth characteristics in the laboratory. Thus, a close relationship was not established between weed population in the field and seedlings growth characteristics in the laboratory.

able 1. Average number of weeds, percent weed control, winter wheat tillers, and wheat yield observed in the field at North Platte, Nebraska during 1979 and 1980.

inter wheat ıltivar or selection	Early weeds[a]	Late weeds: Grasses	Late weeds: Redroot pigweed	Late weeds: Common purslane	Total weeds	Visual estimate of weed control	Winter wheat tillers	Wheat grain yield
	(no./m^2)	(no./m^2)	(no./m^2)	(no./m^2)	(no./m^2)	(%)	(no./m of row)	(kg/ha)
gate	1	3	3	14	21	70	154	3830
ennett	3	6	3	35	47	59	158	3130
enturk 78	1	3	0	4	8	94	185	3340
ancota	1	1	1	6	9	93	191	2580
E76418	1	8	6	35	50	54	193	3370
E76712	6	1	6	19	32	66	200	4200
E77465	3	0	3	1	7	94	178	3740
E77663	0	3	0	1	4	97	185	3220
E77682	1	3	1	12	17	82	176	4030
E78412	3	18	4	36	61	38	136	3050
E78417	1	0	0	1	2	98	178	3160
E78496	3	13	8	58	82	25	130	3410
E78599	1	10	1	12	24	71	172	3640
E78659	3	6	4	12	25	74	183	3850
E78702	1	8	4	12	25	62	170	3760
E78707	3	10	3	35	51	51	155	3020
E78714	3	14	8	49	74	30	129	3570
E78798	1	4	6	12	23	81	184	3870
E78892	4	1	1	32	38	63	140	3070
E78911	1	1	1	18	21	71	148	3190
LSD(0.05)	3	11	6	29	35	35	42	570

[a] Includes kochia, Russian thistle and slimleaf lambsquarter which emerged early in the spring before winter wheat shaded the ground. Late weeds emerged after winter wheat had shaded the soil.

Table 2. Growth characters of 20 cultivars of winter wheat after 5 days growth in a constant 20 C dark growth chamber at 100% relative humidity.

Winter wheat cultivar or selection	Emergence	Shoot length	Seedling roots	Primary root		Lateral roots	
				Length	Depth	Length	Depth
	(%)	(mm)	(no.)	(mm)			
Agate	70	28	3.0	86	81	123	14
Bennett	75	34	3.0	98	93	130	21
Centurk 78	75	34	3.0	95	93	136	27
Lancota	50	26	3.0	80	76	121	20
NE76418	80	32	3.0	88	84	131	18
NE76712	80	33	3.0	100	93	132	22
NE77465	75	31	3.0	95	90	127	21
NE77663	60	33	3.0	91	84	143	29
NE77682	85	38	3.0	112	100	158	46
NE78412	75	30	3.1	86	84	122	11
NE78417	65	28	3.0	85	82	117	15
NE78496	65	25	3.0	85	83	107	21
NE78599	70	27	3.0	86	83	116	23
NE78659	75	31	3.0	88	86	129	26
NE78702	45	22	3.0	90	77	130	17
NE78707	70	28	3.0	89	81	142	26
NE78714	75	19	2.9	103	100	129	25
NE78798	75	22	3.0	86	77	122	13
NE78892	55	23	3.0	65	63	91	21
NE78911	35	9	3.0	43	43	42	8
LSD(0.05)	29	11	0.1	23	22	31	12

B. Identification of parameters that determine the competitive ability of winter wheat cultivars to weeds.

Experiments were carried out to identify the factors that determine competitive ability of winter wheat to weeds, and determine relationships among growth parameters in the greenhouse with observations in the laboratory. Experiments began with 105 cultivars in the laboratory. Subsequently, ten cultivars were selected to ascertain their competitive ability with jointed goatgrass.

Performance of 10 selected cultivars in the laboratory and greenhouse is presented in Tables 3 and 4, respectively. Table 5 gives the correlation coefficient values between emergence percent and plant height in the greenhouse and observations in the laboratory. Emergence percent in the greenhouse was negatively correlated with most of the seedling characteristics observed in the laboratory. Although shoot length in the laboratory correlated positively with plant height in the greenhouse, cultivars with higher shoot length values were not always among the tallest as far as plant height in the greenhouse was concerned. The ability of winter wheat cultivar to overcome competition with weeds was because of high plant population. High emergence for Super x in the greenhouse permitted it to compete better with jointed goatgrass. High emergence percent strongly influenced competitive ability among the cultivars although all of these characters were not always present in the same cultivar.

Table 3. Average germination and seedling growth characters of ten winter wheat cultivars after 5 days growth in a 20 C and 100% relative humidity dark growth chamber.

Winter wheat cultivar[a]	Emergence	Shoot length	Seedling roots	Primary root Length	Primary root Depth	Lateral roots Length	Lateral roots Depth	Total relative value[b]
	(%)	(mm)	(no.)	(mm)	(mm)	(mm)	(mm)	(%)
Clement	85	38	3.1	100	90	150	35	74
Jana	100	52	3.4	115	105	190	50	91
Kopara	85	45	4.1	125	115	215	25	87
NE75549	95	50	2.5	90	80	145	20	71
NS2630/1	90	44	3.2	125	115	220	20	83
At 66/Nap Hal// Norde Desprez 2	75	24	3.9	100	90	160	30	70
At 66/Nap Hal// TX62A2522-1-4	100	29	4.5	110	100	200	20	80
Blueboy II//Nap Hal/CI13449	100	27	4.4	100	90	190	10	72
Kitakomi-komugi/ 3/Nap Hal/- Lancer SD69107	80	27	3.0	105	95	170	40	75
Super x	90	22	3.6	80	70	150	15	62
LSD(0.05)	23	15	0.8	25	25	50	10	12

[a]The first five were selected as the fast growing and the last five were selected as slow growing cultivars.

[b]Total relative value was calculated by giving equal weight (maximum possible value of 14.285% for each observation) for all observations.

Table 4. Growth characters of ten winter wheat cultivars and jointed goatgrass after 15 days growth in the greenhouse at 25 C.

Winter wheat cultivar[a]	Emergence		Plant height		Leaves per plant		Light interception	Total relative value	
	Wheat	Weed	Wheat	Weed	Wheat	Weed		Wheat[b]	Weed[b]
	(%)		(mm)		(no.)		---(%)---		
Clement	60	98	180	208	2.6	2.3	34	83	94
Jana	58	97	200	185	2.7	2.6	29	85	93
Kopara	65	91	188	193	2.7	2.5	37	87	91
NE75549	48	97	180	193	3.1	2.3	37	82	91
NS2630/1	60	91	218	178	3.0	2.5	35	92	88
At 66/Nap Hal// Norde Desprez 2	48	95	188	193	2.7	2.8	29	79	96
At 66/Nap Hal// TX 62A2522-1-4	53	91	180	183	3.0	2.5	35	84	89
Blueboy II//Nap Hal/CI13449	65	99	160	188	3.0	2.2	35	86	89
Kitakomi-komugi/ 3/Nap Hal/- Lancer SD69107	35	93	175	198	2.5	2.6	35	70	93
Super x	73	94	198	195	2.8	2.6	33	93	93
LSD(0.05)	36	ns[c]	39	ns	0.5	0.4	ns	17	ns

[a]The first five were selected as the fast growing and the last five were selected as slow growing cultivars.

[b]Total relative value was calculated by giving equal weight (maximum possible value of 33.33% for each observation) for all observations.

[c]ns = nonsignificant values.

Table 5. Correlation coefficient values between laboratory data and observations in the greenhouse.

Laboratory observations	Greenhouse observations after 15 days growth	
	Emergence percent	Plant height
Observations after 5 days growth		
Emergence percent	ns[a]	ns
Shoot length	-0.32*	0.47*
Number of roots	ns	ns
Primary root length	-0.32*	0.34*
Primary root depth	ns	0.30*
Lateral roots length	ns	0.39**
Lateral roots depth	-0.32*	ns
Total relative value	-0.33*	0.41**

[a]ns means non-significant values while * and ** means significant at the 0.05 and 0.01 level, respectively.

C. Experiments on the study of growth characters of jointed goatgrass.

An experiment was initiated in the greenhouse to determine growth characters in relation to different plant populations of jointed goatgrass. At 2 weeks after planting, number of leaves appeared to have a linear relationship with increasing populations of jointed goatgrass. At 4 weeks after planting, leaf area index was 0.10, 0.14, 0.25, 0.26, and 0.27 with 0.53, 1.07, 1.60, 2.14, and 2.67 million jointed goatgrass population per ha, respectively.

There was no marked difference in the root length due to plant population of jointed goatgrass. However, average root length of weed root was 19, 23, 34, and 42 cm at 1, 2, 3, and 4 weeks after planting.

D. Screening winter wheat cultivars for weed competitiveness.

An experiment was initiated at Clay Center and Lincoln, Nebraska during 1980-81 winter wheat growing season to study the competitive ability of 25 cultivars. At Lincoln, negative correlation occurred between wheat grain yield and kochia, sunflower, or velvetleaf weed counts. Only weight of sunflower and velvetleaf weeds showed significantly negative correlation with grain yield. Total weed number and weed weight also showed significantly negative correlations with wheat grain yields.

E. Screening winter wheat cultivars to downy brome.

Experiments were conducted to investigate the possibility of utilizing the genetic competitive ability of 20 winter wheat cultivars to downy brome at Lincoln and North Platte, Nebraska in 1981-82 winter wheat growing season. Twenty cultivars were planted with and without downy brome. Growth and yield characters of winter wheat cultivars and weed weight in the plots of these cultivars are presented in Table 6 for Lincoln and Table 7 for North Platte. Table 8 summarizes the relationship between the growth characters of winter wheat and weight of weeds both at Lincoln and North Platte. In general, plant height, crop row width, tillers per m^2 area, and weight of tillers per m^2 area had negatively significant correlation with the weight of weeds. Thus, expressed findings indicate the feasibility of this avenue of controlling weeds by incorporating profuse tillering, high tiller weight, and high crop row width characters into the high yielding ability of winter wheat cultivars.

Table 6. Crop growth characters of winter wheat and weight of weeds grown at Lincoln, Nebraska during 1981 and 1982.

Cultivar	Height of wheat		Crop row width		Tillers per m^2		Weight of tillers		Total relative value		Wheat grain yield		Weight of weeds	
	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy
	(cm)						(g/m^2)				(kg/ha)		(g/m^2)	
ate	110	110	17.3	15.7	887	836	960	990	94	91	3290	2760	0	96
nnett	99	97	16.3	13.8	723	660	850	720	83	75	2470	1990	0	173
ckskin	109	105	17.0	14.8	804	636	860	690	89	77	2540	1810	0	109
enturk 78	107	103	16.2	14.7	799	769	990	870	90	84	2870	2220	0	103
agle	104	103	15.3	14.0	700	647	810	850	81	79	2240	1910	0	115
awk	97	96	15.8	12.5	761	606	1010	720	86	71	1860	1310	0	202
E76404	100	96	14.8	13.8	904	811	950	880	88	82	3340	2430	0	179
E77682	103	103	17.0	15.7	813	728	1150	840	94	83	2500	2100	0	95
E78488	103	102	16.2	14.0	756	681	850	720	84	77	2950	2580	0	161
E78659	98	96	16.0	14.0	777	722	960	810	86	78	2320	2170	0	86
E78798	101	92	14.2	12.7	866	682	810	520	83	67	3320	2320	0	197
E79517	108	103	16.3	14.8	718	605	890	790	86	78	2440	1830	0	151
K76W137	104	101	16.2	12.5	787	657	1100	880	91	77	3340	2390	0	181
K76W239	98	98	18.5	16.0	834	849	820	770	88	84	3120	2590	0	108
D73165	108	109	17.0	15.2	800	771	820	860	87	85	2930	2100	0	105
D75284	106	103	14.8	11.5	852	690	1090	890	91	78	2990	2570	0	173
urkey	110	110	16.7	15.7	771	812	880	810	88	86	2060	1540	0	83
X71A889	97	92	17.0	15.0	857	532	950	570	89	68	3260	1980	0	206
X73V203	78	76	16.5	13.2	845	671	830	640	81	67	2550	2040	0	201
ona	89	89	17.8	15.7	840	714	830	710	85	77	2560	2030	0	189
LSD(0.05)	6		2.3		122		260		10		430		35	

Table 7. Crop growth characters of winter wheat and weight of weeds grown at North Platte, Nebraska during 1981 and 1982.

Cultivar	Height of wheat		Crop row width		Tillers per m^2		Weight of tillers		Total relative value		Wheat grain yield		Weight of weeds	
	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy	Weed-free	Weedy
	(cm)						(g/m^2)				(kg/ha)		(g/m^2)	
Agate	96	96	22.3	21.5	710	680	1020	840	90	85	2130	1860	0	75
Bennett	89	90	20.5	19.2	740	670	760	820	82	80	3550	3020	0	120
Buckskin	94	94	22.5	22.3	750	660	1000	900	90	85	2600	2170	0	80
Centurk 78	87	90	23.3	21.8	750	650	720	690	83	79	2460	2380	0	85
Eagle	86	85	20.7	19.0	660	610	770	620	79	73	3000	2270	0	120
Hawk	72	71	21.2	19.2	630	540	820	670	76	68	3020	2240	0	110
NE76404	87	87	18.5	16.7	710	600	790	800	79	74	2990	2860	0	135
NE77682	86	87	21.5	20.7	710	640	760	750	81	78	2730	2350	0	70
NE78488	87	87	20.8	19.3	640	510	970	890	83	75	3270	2860	0	130
NE78659	88	89	24.3	23.0	760	710	700	730	84	82	2450	2240	0	80
NE78798	70	73	17.8	16.3	630	500	870	630	74	63	3690	2770	0	265
NE79517	92	92	24.3	22.8	670	710	860	750	86	84	2670	2420	0	115
NK76W137	81	82	21.3	20.5	690	630	680	770	78	77	2900	2520	0	135
NK76W239	79	78	28.2	28.2	720	640	1070	1150	92	91	2040	1440	0	50
SD73165	95	97	23.8	23.7	700	630	690	840	84	85	2350	1930	0	75
SD75284	90	96	18.8	17.3	690	670	890	890	82	81	3500	3170	0	110
Turkey	95	95	24.7	23.7	740	670	720	830	86	86	1490	1450	0	60
TX71A889	71	73	19.7	18.3	570	520	620	460	68	62	3810	2850	0	155
TX73V203	63	64	18.0	16.3	610	550	440	540	62	61	3690	2790	0	260
Vona	74	70	20.8	19.5	700	570	840	540	77	66	3370	2440	0	140
LSD(0.05)	5		2.3		100		220		6		800		65	

Table 8. Correlation coefficient values between growth characters of winter wheat and weight of weeds at Lincoln and North Platte, NE (based on the observations in wheat planted with downy brome only).

	Weight of weeds	
Growth characters of winter wheat	Lincoln	North Platte
Plant height	-0.68**	-0.67**
Crop row width	-0.59**	-0.75**
Tillers per m^2	-0.57**	-0.66**
Weight of tillers per m^2	-0.56**	-0.60**

**Highly significant (0.01 level).

3. Develop improved methods for controlling problem annual grass weeds in small grain production fields.

   a. Glyphosate carrier volume research. Research in this area has yielded some very positive results. In two years of field and greenhouse research it has been shown that decreasing glyphosate carrier can dramatically increase its phytotoxicity. These data are summarized in Tables 9-12.

Table 9. Effect of carrier volume on glyphosate phytotoxicity in the field during 1980 and 1981 at Lincoln, Nebraska.

Carrier volume	Glyphosate rate	Volunteer wheat	Barnyardgrass	Green foxtail
(L/ha)	(kg/ha)	-----------------	(% control)	-----------------
24	0.1	68	10	91
24	0.2	87	33	98
24	0.4	98	79	99
48	0.1	87	12	91
48	0.2	86	30	94
48	0.4	99	80	100
95	0.1	71	7	65
95	0.2	77	24	92
95	0.4	89	65	100
190	0.1	31	0	35
190	0.2	36	2	64
190	0.4	78	14	95
LSD(0.05)		8	12	8

Similar results were obtained with other grass species and glyphosate rates. Similar experiments were also conducted in the greenhouse.

In conjunction with the research on glyphosate carrier volume the interaction between carrier volume and surfactant concentration was also studied in the field and greenhouse. Results of these experiments indicate that as carrier volume is decreased the effect of surfactant is also reduced or eliminated. Some of the data from this research is shown in Table 10.

Table 10. Effect of carrier volume and surfactant concentration on glyphosate phytotoxicity in the field during 1980 and 1981 at Lincoln, Nebraska.

Glyphosate formulation[a]	Surfactant concentration	Carrier volume	Glyphosate rate	Volunteer oats	Large crabgrass
	(% v/v)	(L/ha)	(kg/ha)	------(% control)-------	
MON-0139	0	24	0.2	88	48
MON-0139	0.5	24	0.2	94	43
MON-2139	---	24	0.2	89	45
MON-0139	0	48	0.2	71	24
MON-0139	0.5	48	0.2	97	80
MON-2139	---	48	0.2	96	64
MON-0139	0	95	0.2	66	34
MON-0139	0.5	95	0.2	98	68
MON-2139	---	95	0.2	93	69
MON-0139	0	190	0.2	42	9
MON-0139	0.5	190	0.2	83	64
MON--2139	---	190	0.2	54	23
LSD(0.05)				10	15

[a]MON-0139 is glyphosate formulated without surfactant; MON-2139 is formulated with 1.8% (v/v) cationic surfactant.

Similar results were noted with other species and rates in the field. Greenhouse experiments corroborated these results.

The effect of glyphosate application date was also examined. Glyphosate was applied 7, 14, 28, and 56 days after oat harvest during 1980 and 1981. Control of grass weeds and volunteer oats was highly effected by environmental conditions. The major conclusion drawn from this experiment is that glyphosate should be applied when weeds are emerged and actively growing, but before they flower.

b. Water quality as it affects glyphosate phytotoxicity. Water hardness has been shown to have a very significant effect on glyphosate phytotoxicity. Water samples from across Nebraska and northern Kansas were collected and tested for their effect on glyphosate phytotoxicity using a greenhouse bioassay. Data from some of the locations are shown in Table 11.

Table 11. Effect of water source on glyphosate toxicity to oats in the greenhouse.

Water source	Carrier volume	Glyphosate rate	Percent control
	(L/ha)	(kg/ha)	
Distilled	24	0.2	78
	190	0.2	58
Chambers, NE	24	0.2	78
	190	0.2	47
Lincoln Agronomy Farm, Lincoln, NE	24	0.2	62
	190	0.2	26
Lincoln, NE	24	0.2	83
	190	0.2	52
Mead, NE	24	0.2	62
	190	0.2	10
North Platte, NE	24	0.2	66
	190	0.2	0
Sidney, NE	24	0.2	57
	190	0.2	34
Scottsbluff, NE	24	0.2	59
	190	0.2	34
Tecumseh, NE	24	0.2	73
	190	0.2	61
Oberlin, KS	24	0.2	40
	190	0.2	77
LSD(0.05)			6

Data from these experiments indicate that the effect of water source on glyphosate phytotoxicity is variable among locations and can be reduced or eliminated by reducing carrier volume to 24 L/ha.

Analysis of these water samples indicated that those which reduced glyphosate phytotoxicity the most also had the greatest concentration of various ions. Greenhouse experiments using solutions of various ions as glyphosate carrier at 190 L/ha indicated that Ca^{++}, Fe^{++}, Fe^{+++}, Mg^{++}, HCO_3^-, CO_3^{--}, and Zn^{++} would inhibit glyphosate phytotoxicity and that their effects are additive.

In an attempt to overcome this inhibition of glyphosate, acids were added to well water and used as the glyphosate carrier. Some of the results are summarized in Table 12.

Table 12. Effect of acid addition to glyphosate solutions in the field during 1981 at Lincoln, Nebraska.

Glyphosate rate	Distilled water	Well water	Acids added to the well water carrier						
			H_2SO		HCl		CH_3COOH		Vinegar
			10 mM	50 mM	10 mM	50 mM	10 mM	50 mM	5% (v/v)
(kg/ha)	(% stand reduction)								
0.2	84	41	88	91	38	60	63	57	31
0.4	99	59	96	97	75	83	83	92	96
0.8	100	98	99	100	94	96	96	99	99
LSD(0.05)	9								

These results corroborated greenhouse data. In addition to the acids mentioned above, several other acids were examined in the greenhouse, but none gave the results that H_2SO_4 did. The reason for this response is unclear, but it appears that the formation of $CaSO_4$ when H_2SO_4 is added to the spray solution may be a major factor. Further research is now being conducted examining this possibility.

c. Comparison of controlled droplet applicators and flat fan nozzles for the applications of glyphosate. Field experiments were established during 1981 and 1982 to compare controlled droplet applicators (CDA) to flat fan nozzles when applying glyphosate at equal carrier volumes. Volunteer wheat control (Table 13) was similar using the different application methods except at 0.2 kg/ha glyphosate in 24 L/ha of solution where control using the flat fan nozzles was better and at 0.2 kg/ha glyphosate in 190 L/ha of solution where the CDA resulted in better control. Large crabgrass control was more variable with the flat fan nozzles giving better control in many cases. Only at 0.4 kg/ha glyphosate in 190 L/ha did the CDA give control superior to flat fan nozzles.

Table 13. Effect of application method on the control of volunteer wheat and large crabgrass with glyphosate in the field during 1981 and 1982 at Lincoln, Nebraska.

Glyphosate rate	Carrier volume	Nozzle type	Volunteer wheat[a]	Large crabgrass[b]
(kg/ha)	(L/ha)		-------(% control)-------	
0.2	24	CDA	88	30
0.2	24	Flat fan	98	60
0.4	24	CDA	96	43
0.4	24	Flat fan	99	85
0.2	48	CDA	93	43
0.2	48	Flat fan	99	70
0.4	48	CDA	99	78
0.4	48	Flat fan	100	85
0.2	95	CDA	90	44
0.2	95	Flat fan	98	65
0.4	95	CDA	98	66
0.4	95	Flat fan	99	76
0.2	190	CDA	73	10
0.2	190	Flat fan	49	0
0.4	190	CDA	98	70
0.4	190	Flat fan	92	20
LSD(0.05)			8	11

[a]Mean of 1981 and 1982 experiments.

[b]1982 experiment only.

4. Study the control of common milkweed in winter wheat production systems.

Influence of glyphosate on common milkweed (*Asclepias syriaca* L.) populations in continuous winter wheat. Field experiments were initiated in early September of 1980 to determine the potential of glyphosate applications during the non-cropped period in reducing the number of years of continuous wheat required to eradicate common milkweed. Winter wheat is planted in mid to late September and is harvested in early July, leaving a non-cropped period from July to September. Common milkweed was allowed to grow undisturbed during this non-cropped period. Stem counts of common milkweed were taken in each plot just prior to glyphosate applications and annually thereafter for 2 years, to determine the effectiveness of various glyphosate treatments. All treatments were applied when the common milkweed regrowth was at the late bud to early bloom stage of growth, just prior to seeding of winter wheat.

Broadcast glyphosate applications to common milkweed in early September ranged from 1.1 kg/ha to 4.5 kg/ha. Applications to individual 9 x 15 m plots were applied in 190 L/ha of well water at a 200 kPa pressure by a tractor-mounted broadcast shielded sprayer at 6.4 km/h. Selective equipment applications to common milkweed were applied at 1:4 and 1:2 v/v of glyphosate: water ratio. Two pieces of selective equipment, a pipe ropewick and a Broyhill Bobar, were tested both single pass and double pass in opposite directions at the aforementioned rates. The pipe ropewick construction consisted of a PVC sewer pipe with three rows of peppermint type poly-acrylic cord glued into the pipe. A commercial Broyhill Bobar applicator was used. All herbicide treatments were randomized in a complete block design and replicated four times.

Broadcast applications of glyphosate did reduce the common milkweed population by 99% the first year after treatment and 90% the second year after treatment (See Table 14). Little difference in control levels were noted as the glyphosate rate increased from 1.1 kg/ha to 4.5 kg/ha. The 10% drop in control from 1981 to 1982 is probably due to a very dry 1981 July to September non-crop period resulting in very little common milkweed regrowth. The 1982 July to September non-crop period received adequate rainfall resulting in increased common milkweed regrowth. Common milkweed infestations were reduced by 92% the first year and 82% the second year in the check. This control is due to the competition produced by the continuous winter wheat. Again the 10% drop in control is thought to be associated with the rainfall differences during the two non-crop periods. A comparison of the broadcast glyphosate treated areas to those receiving no glyphosate treatments reflects about an 8% better common milkweed control in both the first and second year after treatment.

Selective equipment applications of glyphosate also reduced the common milkweed population by a range of 99 to 93% the first year and 89 to 84% the second year after treatment (See Table 15). The only notable difference between the various selective equipment applications was obtained with a 1:4 v/v of glyphosate:water ratio applied with a pipe ropewick one pass, giving common milkweed control just slightly above the check. This lower control rating is probably due to the lack of glyphosate being applied to the common milkweed, due to one pass application, and the low percent v/v ratio of glyphosate:water. Overall selective equipment applications of glyphosate produced similar common milkweed control, both one and two years after application, as compared to broadcast applications of glyphosate. The 10% drop in common milkweed control from the first year after application to the second year after application may reflect common milkweed recovery

following treatment.

It appears that broadcast applications of glyphosate at 1.1 kg/ha or greater and selective equipment applications, other than a pipe ropewick application at 1:4 glyphosate:water ratio, one pass, does reduce the infestation of common milkweed more effectively than continuous winter wheat itself. Competition from winter wheat alone for 2 years was effective on substantially reducing the common milkweed infestations.

Table 14. The effects of glyphosate applications on common milkweed.

Broadcast glyphosate rate	Percent control common milkweed	
	1 yr after treatment	2 yr after treatment
1.1 kg/ha	98	90
2.2 kg/ha	99	91
3.4 kg/ha	99	91
4.5 kg/ha	99	89
Check	92	82

Table 15. The effects of glyphosate selective equipment applications on common milkweed.

Selective equipment	Glyphosate:water v/v	Percent control common milkweed from initial counts	
		1 yr after treatment	2 yr after treatment
Ropewick	1:4 1 pass	93	84
Ropewick	1:4 2 pass	98	89
Ropewick	1:2 1 pass	98	85
Ropewick	1:2 2 pass	96	88
Bobar	1:4 1 pass	98	87
Bobar	1:4 2 pass	98	87
Bobar	1:2 1 pass	99	89
Check	---	92	82

5. Develop weed control methods for no-tillage production systems involving small grains and associated row crops in the Great Plains.

a. Field experiments are continuing at Lincoln, North Platte, and Sidney, Nebraska investigating selective weed control systems in growing wheat and during the fallow period while producing continuous no-till winter wheat.

Complete data on these experiments are not yet available, but some general observations at Lincoln are as follows:

1. Control of volunteer wheat and other weeds with a single herbicide application is a problem. In 1981, neither cyanazine or metribuzin gave sufficient volunteer wheat control when applied after harvest. In 1982, cyanazine gave over 90% volunteer wheat control while metribuzin controlled about 30%.

2. Cyanazine and metribuzin have not carried over to the subsequent winter wheat crop when applied after wheat harvest.

3. Control of emerged weeds after wheat harvest has been excellent with both paraquat and glyphosate applied at 1 pt/A.

4. Weed pressure when making spring applications of chlorsulfuron, metolachlor, and pendimethalin was low, but these applications did result in reduced weed populations at wheat harvest.

5. Spring applications of chlorsulfuron, 2,4-D ester, chlorsulfuron + pendimethalin, and chlorsulfuron + metolachlor did not visibly injure wheat, delay bloom, or reduce wheat yields.

From the results obtained from this research thus far it appears that weeds can be controlled in continuous no-till wheat in eastern Nebraska without injuring the crop. The only problem may be that a postemergence herbicide may have to be applied to volunteer wheat in some years before the planting of the next winter wheat crop.

b. Annual grass control in no-tillage soybean production. Several experiments are now in progress involving annual grass control in soybeans without the aid of tillage. This research involves three new grass herbicides: fluazifop-butyl, sethoxydim, and Dowco 453. Several aspects of these herbicides are being examined in field, greenhouse, and laboratory experiments. Effects of carrier volume, application timing, and oil concentration on postemergence activity are being investigated along with soil aspects; herbicidal effects on plant transpiration; and absorption, translocation, and metabolism. Some data in these areas have been collected, but no conclusions can be drawn at this time. These herbicides appear to be promising alternatives to tillage and soil incorporated herbicides for the control of annual grasses, as well as rescue treatments in soybean production.

c. Effect of nitrogen rates and three cultivars of winter wheat on weed control. Three cultivars of winter wheat were planted in the fall of 1981 (Tables 16-19). One-half of the plots were broadcast fertilized with NH_4NO_3. Nitrogen was applied March 22, 1982 on designated plots for the spring treatment. Nitrogen rates for fall and spring were 0, 30, 60, and 90 lb/A.

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Cultivars included short statured, and tall types. They are Centurk 78, Eagle, and Lancota. During the growing season, weeds were counted in each plot. The number of weeds between fertilizer treatments for fall and spring is variable, and does not give an indication of any trends. In general, Centurk 78 had the least amount of weeds, then Lancota, and Eagle, respectively. This trend held for most nitrogen treatments, and is important as it indicates which cultivar is most competitive with weeds. Post-harvest observations and weights of 10 grass plants/pot support what was determined from the weed counts. Weed counts were made 3 times during the growing season. As shown in the tables, the population of weeds decreased over the summer probably due to low moisture conditions and high competitive ability of wheat with grass weeds. Spring treatments of fertilizer gave rise to higher populations of grasses among most treatments.

Yields varied greatly among the fertilizer treatments. This could have been due to variations in weed populations among plots, and lodging at higher rates of nitrogen. Centurk 78 gave the highest yields in both spring and fall treatments, then Lancota, and Eagle, respectively. Yields were higher for all cultivars when fall fertilized. One-Hundred seed weight and head weight were higher for Eagle and Lancota, but this was due to less tillering in these 2 varieties as compared to Centurk 78.

Table 16. Fall applied nitrogen in 1981 to three wheat cultivars at North Platte, Nebraska.

Variety	N-lb/A	Yields kg/ha	Yields Bu/A	Lodging score 1 = straight 10 = flat	100 seed wt (g)	Head wt (g)	Culm/m^2
Centurk 78	0	3360	50.1	3	3.00	11.50	2003
	30	3192	47.5	4	2.96	10.90	2159
	60	3360	50.0	3	2.81	12.00	2276
	90	2876	42.8	6	2.80	10.60	2115
Mean		3197	47.6		2.89	11.25	2138
Eagle	0	2647	39.4	2	3.62	12.75	1885
	30	2889	43.0	2	3.63	11.95	2193
	60	2614	38.9	3	3.60	12.40	1786
	90	2983	44.4	3	3.25	13.05	1771
Mean		2782	41.4		3.52	12.53	1908
Lancota	0	3259	48.5	1	3.53	18.45	1763
	30	2251	33.5	2	3.55	16.32	1854
	60	2768	41.2	1	3.50	15.60	1853
	90	2970	44.2	1	3.46	12.25	1916
Mean		2822	42.0		3.51	16.90	1846

Table 17. Spring applied nitrogen on March 22, 1982 to three wheat cultivars at North Platte, Nebraska.

Variety	N-lb/A	Yields		Lodging score	100 seed wt (g)	Head weight (g)	Culm/m^2
		kg/ha	Bu/A	1 =straight 10=flat			
Centurk 78	0	2483	37.1	4	2.9	10.9	2630
	30	3225	48.0	3	3.1	11.8	2124
	60	2983	44.4	5	2.7	10.0	2367
	90	2808	41.8	5	2.6	12.0	2457
Mean		2876	42.8		2.8	11.2	2394
Eagle	0	2755	41.0	2	3.6	13.5	1793
	30	3010	44.8	4	3.7	7.1	1438
	60	2237	33.3	3	3.5	12.3	2040
	90	2721	40.5	5	3.5	12.3	1879
Mean		2688	40.0		3.5	11.3	1787
Lancota	0	2311	34.4	1	3.6	17.2	1629
	30	3232	48.1	2	3.6	18.7	1902
	60	2614	38.9	1	3.4	18.6	1729
	90	2284	34.0	2	3.3	18.0	1972
Mean		2620	39.0		3.5	17.9	1808

Table 18. Fall applied nitrogen in 1981 to the wheat cultivars at North Platte, Nebraska.

Variety	N-lb/A	5-17-82 Grass/m^2	6-4-82 Grass/m^2	7-1-82 Grass/m^2	Visual observation % weeds/plot	Weight (g) 10 plts/plot
Centurk 78	0	667	569	392	7.00	.393
	30	1078	845	537	6.90	.312
	60	599	591	286	4.50	.430
	90	602	453	355	2.30	.49
Mean		736	614	392	5.10	.406
Eagle	0	1372	1067	671	25.75	.80
	30	1165	1157	689	27.25	.91
	60	882	704	559	26.25	.71
	90	1263	1234	660	20.12	.51
Mean		1170	1040	644	24.84	.73
Lancota	0	998	816	540	6.25	.38
	30	631	471	360	8.75	.42
	60	903	821	471	5.12	.34
	90	1263	1285	591	5.25	.46
Mean		948	848	492	6.34	.4

Table 19. Spring applied nitrogen on March 22, 1982 on three wheat cultivars at North Platte, Nebraska.

Variety	N-lb/A	5-17-82 Grass/m^2	6-4-82 Grass/m^2	7-1-82 Grass/m^2	Visual observation % weeds/plot	Weight (g) 10 plts/plot
Centurk 78	0	900	762	421	8.50	.37
	30	892	479	417	6.10	.32
	60	1052	1063	497	7.70	.25
	90	1869	704	363	4.10	
Mean		1178	752	424	6.60	.3
Eagle	0	1223	726	519	27.37	.58
	30	1720	1680	813	23.37	.65
	60	1865	1604	689	21.5	.65
	90	780	936	308	11.35	.71
Mean		1397	1236	582	20.89	.64
Lancota	0	969	1081	450	5.25	.46
	30	1698	1571	733	3.75	.36
	60	1288	1194	602	1.75	.32
	90	1372	860	435	3.00	.40
Mean		1331	1176	555	3.43	.38

d. Influence of plant residue on weed and crop yields. The objective of this study was to determine the effect of amount of wheat straw mulch during the growing season on the growth and yield of corn and on weed control at Wilber, North Platte, and Sidney, Nebraska (Table 20). The wheat stubble was treated with atrazine in the fall to control volunteer wheat. Five mulch levels were produced in the spring by adding or removing the wheat straw naturally present on the plots. Corn was planted with a no-till planter one to two months later. Five pre-emergence herbicide treatments of metolachlor and atrazine were applied. Data are given in Tables 20-32.

At North Platte in 1981, corn stand decreased slightly at 6720 kg/ha of mulch, but in 1982, corn stand was lower on the bare plots due to silting and crusting from rain after planting. In 1981 and 1982 at Sidney, corn stand decreased as the mulch level increased. Before tasseling corn height decreased as mulch level increased. After tasseling, the reverse (corn height increased as mulch level increased) was generally true. Percent seed moisture at harvest increased as mulch level increased. In 1982 at North Platte, silking on the 6720 kg/ha plots was delayed 4 days versus the bare plots. These measurements indicate that the lower soil temperatures under mulch retarded early season corn growth. In 1981, forage and total dry matter production increased as the mulch level increased. Even though the mulch retarded early season corn growth, the overall growth was increased by later growth, probably due to more favorable moisture conditions with increasing mulch level.

In 1981, seed weight generally increased as the mulch level increased. The corn grain yield seemed to correlate well with the seed/ha produced. Corn grain yield was highest at the 6720 kg/ha mulch level at Wilber, at the 3360 to 5040 kg/ha level at North Platte, and at the 0 to 3360 kg/ha level at Sidney. The mulch level for maximum yield decreased from east to west across Nebraska. The number of growing degree-days also decreases from east to west.

Generally, as the mulch level increased, the weed growth (both in numbers and in weight/area) decreased. At the higher mulch rates, weeds tended to grow in the bare soil of the planter row, rather than in the mulch itself. Mulching reduced weed growth whether the plots were treated with herbicide in the spring or not. At each herbicide treatment, rather than the mulch reducing weed control by tying up herbicides, the weed control generally increased as the mulch level increased. Thus, suppression of weed growth by the mulch was more important than any negative effect that tying up herbicide may have on weed control.

At North Platte and Sidney, studies were conducted in which the mulch levels were adjusted prior to herbicide application in the fall (Table 31). At Lincoln, wheat stubble was sprayed with glyphosate in the fall of 1981 to control volunteer wheat. Straw levels were adjusted 4-14-82. Corn was not planted and the plots were not sprayed in the spring because the soil was too wet for too long. So weed growth was measured with 20 reps per mulch level (Table 32). In all 3 studies, weed growth was reduced as mulch level increased. So the reduced weed growth in the other studies weren't due to the removal and addition of atrazine when the mulch level adjustments were performed.

Table 20. Operations performed at each location in mulch studies across Nebraska.

Treatments	Wilber	North Platte	Sidney
a. Growing season mulches			
Atrazine rate (kg/ha) applied to wheat stubble in fall	3.36	2.8	1.12
Date of mulch level adjustment	4-7-81 --	3-26-81 3-24-82	3-27-81 3-26-82
Date of corn planting	5-15-81 --	6-2-81 6-3-82	4-30-81 4-30-82
Date of spring herbicide application	5-15-81 --	6-3-81 6-7-82	5-8-81 5-3-82
Corn variety	Neb611	Pioneer 3901	Pioneer 3901
b. Fallow plus growing season mulch			
Date of mulch level adjustment		8-24-81	8-14-81
Date of atrazine application		8-29-81	8-19-81
Rate (kg/ha) of atrazine application		2.8	1.12
Date of spring herbicide application		6-7-82	5-3-82
Spring herbicide treatment		1.68 kg/ha metolachlor + paraquat	0.56 kg/ha atrazine + glyphosate

Table 21. Effect of wheat mulch on corn growth at several locations in Nebraska in 1981 and 1982.

Straw level	Corn Plants/ha					
	Wilber	North Platte		Sidney		Mean
(kg/ha)	1981	1981	1982	1981	1982	
0	28100	34400	28900	21700	24400	27500
1680	28200	34700	29800	21000	24000	27500
3360	27100	34600	29700	21400	23600	27300
5040	28100	34200	29700	20900	23200	27200
6720	27700	33700	30000	19700	22200	26700

Straw level (kg/ha)	Corn height before tasseling, cm				Mean
	North Platte		Sidney		
	7-2-81	7-7-82	7-4-81	7-1-82	
0	27.9	36.8	41.9	31.7	34.6
1680	27.4	32.8	39.9	28.6	32.2
3360	25.1	31.2	39.1	26.8	30.6
5040	25.4	31.0	34.5	26.9	29.5
6720	24.1	29.2	32.3	24.4	27.5

Straw level (kg/ha)	Corn height after tasseling, cm					Mean
	Wilber	North Platte		Sidney		
	1981	1981	1982	1981	1982	
0	171	178	164	146	168	165
1680	179	180	175	149	178	172
3360	178	183	179	149	180	174
5040	182	190	179	151	181	177
6720	188	192	183	150	179	178

Straw level (kg/ha)	Days that silking was delayed after 8-4-82 at North Platte
0	0.4
1680	2.3
3360	2.7
5040	3.1
6720	4.0

Table 22. Effect of wheat mulch level on corn growth at three locations in Nebraska in 1981.

Straw level	Wilber	North Platte	Sidney
(kg/ha)			
	Percent seed moisture at harvest		
0	19.6 b	23.7 c	24.1 d
1680	26.1 a	24.2 c	27.0 c
3360	26.6 a	25.0 bc	27.6 c
5040	26.7 a	26.7 a	29.5 b
6720	28.1	26.5 ab	33.3 a
	Forage dry matter production, kg/ha[a]		
0	6000 c	9800 c	3370 ab
1680	8200 bc	10700 bc	2800 b
3360	9100 bc	12300 abc	2770 b
5040	11000 ab	13100 ab	3780 a
6720	13000 a	13800 a	4060 a
	Total dry matter production, kg/ha[a]		
0	13700 c	15300	11500 a
1680	16400 bc	16200	9400 b
3360	16000 bc	18200	8900 b
5040	18800 ab	17500	11700 a
6720	20800 a	17500	12200 a

[a] 10-8-81 at Wilber, 9-26-81 at North Platte, and 9-27-81 at Sidney.

Table 23. Effect of wheat mulch level on corn yield components in 1981. Yield = plants/area x ears/plant x seed/ear x weight/seed.

Straw level	Components of yield				Yield
	Plants/ha	Ears/plant	Seed/ear	kg/seed x 10^{-6}	
(kg/ha)					(kg/ha)
			Wilber		
0	28100	0.960	606	300	4888 c
1680	28200	1.044	605	311	5538 b
3360	27100	1.039	604	323	5484 b
5040	28100	1.029	609	326	5732 ab
6720	27700	1.035	631	334	6046 a
			Percentage of bare plots at Wilber		
0	100	100	100	100	100
1680	100	109	100	104	113
3360	97	108	100	108	112
5040	100	107	100	109	117
6720	99	108	104	111	124
			North Platte		
0	34400	1.35	446	268	5546 c
1680	34700	1.41	463	270	6127 bc
3360	34600	1.56	436	276	6479 ab
5040	34200	1.69	411	276	6563 a
6720	33700	1.62	399	273	5972 c
			Percentage of bare plots at North Platte		
0	100	100	100	100	100
1680	101	104	104	101	111
3360	100	116	98	103	117
5040	100	125	92	103	118
6720	98	120	90	102	108
			Sidney		
0	21700	1.76	472	270	3982 a
1680	21000	1.83	440	283	3930 ab
3360	21400	1.86	421	292	4092 a
5040	20900	1.89	394	294	3659 bc
6720	19700	2.15	333	289	3430 c
			Percentage of bare plots at Sidney		
0	100	100	100	100	100
1680	98	104	93	105	99
3360	101	106	89	108	103
5040	94	107	83	109	92
6720	93	122	71	107	86

Table 24. Effect of wheat mulch level on corn yield components in 1981. Yield = seed number x seed weight.

Straw level (kg/ha)	Wilber	North Platte	Sidney
	Seed weight, 10^{-6} kg/seed		
0	300 c	268 b	270 c
1680	311 b	270 ab	283 b
3360	323 a	276 a	292 a
5040	326 a	276 a	294 a
6720	334 a	273 ab	289 ab
	Millions of seed/ha		
0	16.3 b	20.7 c	14.8 a
1680	17.8 a	22.7 ab	13.9 a
3360	17.0 ab	23.6 a	14.1 a
5040	17.6 ab	23.8 a	12.5 b
6720	18.1 a	21.8 bc	11.9 b
	Dry corn yield, kg/ha		
0	4888 c	5546 c	3982 a
1680	5538 b	6127 bc	3930 ab
3360	5484 b	6479 ab	4092 a
5040	5732 ab	6563 a	3659 bc
6720	6046 a	5972 c	3430 c
	Seed weight, percent of bare plot		
0	100	106	100
1680	104	101	105
3360	108	103	108
5040	109	103	109
6720	111	102	107
	Seed/ha, percent of bare plot		
0	100	100	100
1680	109	110	95
3360	104	114	95
5040	108	115	84
6720	111	105	81
	Corn yield, percent of bare plot		
0	100	100	100
1680	113	111	99
3360	112	117	103
5040	117	118	92
6720	124	108	86

Table 25. Effect of wheat mulch level and rate of metolachlor on weed growth at North Platte, Nebraska. Metolachlor was applied 6-3-81.

	Metolachlor, kg/ha					
Wheat straw	0	0.84	1.68	2.52	1.68 + 1.68 atrazine	Mean
(kg/ha)						
			Total number of weeds/ha on 8-26-81			
0	48799	7033	6028	2727	0	12917
1680	45067	5310	7176	1866	0	11884
3360	16936	1579	718	861	143	4047
5040	5310	144	144	144	0	3100
6720	14783	0	718	0	0	1148
Mean	26179 a	2957 b	2813 b	1119 b	28 b	
			Total weed weights/ha on 8-26-81			
0	2062	141	57	106	0	473
1680	2450	286	148	47	0	586
3360	841	72	18	0	0	186
5040	220	0	0	0	0	44
6720	794	0	0	0	0	159
Mean	1273 a	100 b	45 b	30 b	0 b	
			Thousands of weeds/ha on 6-10-82			
0	5058	630	288	588	355	1384
1680	2125	893	545	465	168	839
3360	1448	823	245	163	318	599
5040	500	163	188	193	233	255
6720	883	130	160	115	223	302
Mean	2003	528	285	305	259	

Table 26. Effect of wheat mulch level and rate of metolachlor on weed growth at Wilber, Nebraska. Metolachlor was applied 5-15-81.

Wheat straw	Metolachlor, kg/ha 0	1.12	2.24	3.36	2.24 + 2.24 atrazine	Mean
(kg/ha)						
			Total number of weeds/ha on 9-10-81			
0	5630	4520	5190	1700	0	3410 a
1680	10670	820	1630	3260	220	3320 a
3360	9340	1850	2670	0	0	2770 ab
5040	6000	2670	4520	440	0	2730 ab
6720	2080	0	220	0	0	460 b
Mean	6750 a	1970 bc	2850 b	1080 bc	40 c	
			Total weed weight, kg/ha on 9-10-81			
0	412	240	350	163	2	233 ab
1680	1412	80	84	167	45	357 a
3360	326	124	134	15	0	120 ab
5040	326	239	62	41	2	136 ab
6720	92	0	6	19	0	23 b
Mean	516 a	136 b	127 b	81 b	10 b	
			Thousands of weeds/ha on 6-1-82			
0	333	255	158	335	408	296
1680	128	313	253	133	188	203
3360	178	308	285	163	90	205
5040	83	170	193	123	328	179
6720	78	185	100	130	353	169
Mean	158	246	198	177	273	

Table 27. Effect of wheat mulch level and herbicide rate on weed growth at Sidney, Nebraska. Metolachlor was applied 5-8-81.

	Metolachlor, kg/ha					
Wheat straw	0	0.56	1.12	1.58	1.12 + 1.12 atrazine	Mean
(kg/ha)						
			Total number of weeds/ha on 9-25-81			
0	14640	2727	1292	430	0	3818
1680	11913	4736	1148	2727	0	4105
3360	4880	2296	1722	2153	0	2210
5040	6315	2583	2583	2583	2583	3330
6720	1005	0	3158	4880	0	1808
Mean	7750 a	2469 b	1981 b	2555 b	517 b	
			Total weed weights, kg/ha on 9-25-81			
0	271	80	45	2	0	80
1680	230	93	18	32	0	75
3360	150	29	45	45	0	54
5040	62	25	32	25	32	35
6720	19	0	77	73	0	34
Mean	146 a	45 b	43 b	35 b	6 b	
			Thousands of weeds/ha on 5-22-82			
0	93	170	60	190	75	118
1680	150	265	78	138	43	135
3360	115	145	178	143	25	121
5040	128	105	118	118	25	99
6720	148	120	43	135	63	102
Mean	127	161	95	145	46	

Table 28. Effect of wheat mulch level and rate of metolachlor on weed growth at Sidney, Nebraska on 8-7-82.

	Metolachlor, kg/ha, applied 5-3-82					
Wheat straw	0	0.56	1.12	1.58	1.12 + 1.12 atrazine	Mean
(kg/ha)						
			Thousands of weeds/ha			
0	415	115	79	33	0	129
1680	315	42	23	20	0	80
3360	129	23	26	15	0	39
5040	108	43	17	9	0	35
6720	104	31	14	5	0	31
Mean	214	51	32	16	0	
			Total weed weight, kg/ha			
0	2654	1047	831	419	0	990
1680	3404	522	319	255	0	900
3360	1747	208	280	237	0	495
5040	1298	512	232	116	0	432
6720	1058	392	186	56	0	339
Mean	2032	536	370	217	0	

Table 29. Effect of wheat mulch level and rate of metolachlor on weed growth at North Platte, Nebraska on 8-13-82.

	Metolachlor, kg/ha, applied 6-7-82					
Wheat straw	0	0.84	1.68	2.52	1.68 + 1.68 atrazine	Mean
(kg/ha)						
			Thousands of weeds/ha			
0	226	113	25.5	19.5	0	76.3
1680	238	15.9	36.2	28.3	0	63.7
3360	251	3.2	2.0	0.3	0	51.2
5040	111	4.2	6.9	0	0	24.4
6720	27.7	0.7	3.4	0.1	0	6.5
Mean	171	27.4	14.2	9.6	0	
			Total weed weight, kg/ha			
0	807	875	191	175	0	410
1680	821	46	170	111	0	230
3360	633	7	6	2	0	129
5040	296	8	15	0	0	64
6720	51	3	7	0	0	12
Mean	521	188	78	58	0	

Table 30. Effect of wheat straw mulch on weed control in ecofallow corn in 1981 and 1982.

Straw level	Wilber	North Platte		Sidney		Mean
	9-10-81	8-26-81	8-13-81	9-25-81	8-7-82	
(kg/ha)						
			Number of weeds/ha			
0	3400	12900	76300	3800	128500	45000
1500	3300	11900	63700	4100	79900	32600
3000	2800	4000	51200	2200	38700	19800
4500	2700	3100	24400	3300	35300	13800
6000	500	1100	6500	1800	30700	8100
			Weed weights, kg/ha			
0	233	473	410	80	990	437
1500	357	586	230	75	900	430
3000	120	186	129	54	495	197
4500	136	44	64	35	432	142
6000	23	159	12	34	339	113

Table 31. Effect of wheat mulch level on weed control in ecofallow corn. Wheat mulch level was adjusted after wheat harvest (8-24-81 at North Platte and 8-14-81 at Sidney). Atrazine plus paraquat was then applied at North Platte on 8-29-81 and at Sidney on 8-19-81. At North Platte metolachlor + glyphosate was applied on 6-7-82. At Sidney, glyphosate was applied 4-29-82 and atrazine on 5-3-82.

Straw level (kg/ha)	Corn plants/ha North Platte	Corn plants/ha Sidney
0	29900	25500
1680	30200	25200
3360	29100	26600
5040	29800	24400
6720	29800	25200

	Number of weeds/ha		
	North Platte		Sidney
	5-31-82	7-8-82	7-3-82
0	910000	23500	16500
1680	460000	10900	8600
3360	235000	1400	9300
5040	260000	1100	3600
6720	185000	1400	4300

Table 32. Effect of wheat mulch on weed growth at Lincoln, Nebraska in 1982. Wheat stubble was sprayed with glyphosate in fall of 1981. Straw levels were adjusted 4-14-82.

Straw level (kg/ha)	Number of broadleaf weeds/ha 6-1-82	6-18-82	7-17-82
0	187700	222400	73200
1680	71700	113000	30200
3360	41200	64600	13200
5040	18500	37100	11000
6720	6000	10200	6700
	Weed weights on 7-13-82, kg/ha		
0	2200		
1680	883		
3360	433		
5040	265		
6720	67		

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